

Rikaline GPS-300

GPS Receiver

User's Guide

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0. Quick Use

0.1 Check GPS Package

0.1.1 Standard Package

Main Unit: GPS Receiver and Power Converter built in the housing.

Mounting Accessories: Metal Bracket + 2 Screws (for plastic) Comes Fixed with Glue

Cable Ties x 4 pieces

Velcro (Adhesive Tapes) x 1 Set (When using on the dashboard)

Power Cable: 1.5m with connector & Fuse + Rocker Switch +2m Baring End + A pair Close-end Wire
Connector x 3 Sets in Different Diameter.

External Active Antenna (A-10305-SA): SMA connector, 5m Cable, 26dB Gain

Data Cable (A-6018-C): 1.5m RS-232 with Positioning Status LED.

Miscellaneous: CD + Warranty Card + Quick installation reference.

0.1.2 Optional Package

The shop may bundle different accessories for you as follows:

1. PDA Cable Connector
2. Software (Navigation Software + Digital Map)
3. Others

0.2 Check connector

1. A-6018-C RS-232 Serial Port Connector for PC/Laptop or PC based system.
2. A-6020 USB cable for USB interface PC or PC based system. While connecting with USB Connector, please install USB driver first.
3. When you connect your PDA to GPS-300, you need an optional cable A-6019 series.
4. Various cables are ready for optional devices.
5. Connect External Active Antenna to GPS-300.

0.3 Plan your installation

You must decide where and how to install the following items separately, then your installation procedure is different to follow.

1. How and Where to install the main unit:
 - a. Under instrument cabinet: with cable tie or screw.
 - b. On dashboard: with velcro (Adhesive Tapes).
2. Active Antenna: on dashboard, roof, top of trunk or in the back.
3. Power Supply: Before or after the ignition switch.
4. Switch: Punch a hole to install it or put it at a suitable place.
5. For PC or PDA.
6. For permanent or temporary use.

0.4 Connect GPS-300 to Car Power.

Be sure to connect car power after IGNITION SWITCH to prevent running out of power if you forget to switch off GPS-300 when you get off the car. If you like your unit always stays at ON, you may connect the unit before ignition switch. (**Warning:** If you do not switch off the unit when you park the car, your battery will run out of if the unit input power connected before ignition switch.)

0.5 Turn on Your device.

0.6 Your GPS-300 starts to provide you full GPS function.

1. Introduction

1.1 Overview

The **Rikaline GPS-300 Black Box** is a total solution GPS receiver, designed based on **SiRF Star II** Architecture. It is pre-installed and fixed in your car or boat without extra wiring. This positioning application meets strict needs such as car navigation, mapping, surveying, security, agriculture and so on. It communicates with other electronic utilities via compatible dual-channel through RS-232 or TTL and saves critical satellite data by built-in backup memory. With low power consumption, the **GPS-300** tracks up to 12 satellites at a time, re-acquires satellite signals in 100 ms and updates position data every second.

1.2 Features

The GPS-300 provides a host of features that make it easy for integration and use.

1. **SiRF Star II** chipset with embedded ARM7TDMI CPU available for customized applications in firmware.
2. High performance receiver tracks up to 12 satellites while providing first fast fix and low power consumption.
3. Differential capability utilizes real-time RTCM corrections producing 1-5 meter position accuracy.
4. Compact design ideal for applications with minimal space.
5. A rechargeable battery sustains internal clock and memory. It is recharged during normal operation.
6. User initialization is not required.
7. Dual communication channels and user selectable baud rates allow maximum interface capability and flexibility.
8. Optional communication levels, RS-232 and TTL meet ordinary application and new fashions of connecting PDA with TTL or RS-232 output.
9. FLASH based program memory: New software revisions upgradeable through serial interface.
10. LED display status: The LED provides users visible positioning status. LED "Blinking" when power connected and "Stays ON" when GPS-300 position identified. No more extra device needed.
11. Built-in WAAS demodulator.
12. Full set accessory for installing in the car and using with your devices.

1.3 Technology specifications

1.3.1 Physical Dimension

Single construction integrated antenna/receiver.

Size: 120.0(W) x 80.0 (D) x 26.0(H) (mm)

4.72"(W) x 3.15" (D) x 1.02"(H).

1.3.2 Environmental Characteristics

- 1) Operating temperature: -40°C to +85°C(internal temperature).
- 2) Storage temperature: -55°C to +100°C.

1.3.3 Electrical Characteristics

- 1) Input voltage: +6 ~ 30VDC with power wire
- 2) Backup power: 3V Rechargeable Lithium cell battery, up to 767 hours (31.9 days) discharge.

1.3.4 Performance

- 1) Tracks up to 12 satellites.
- 2) Update rate: 1 second.
- 3) Acquisition time

Reacquisition	0.1 sec., averaged
Hot start	8 sec., averaged
Warm start	38 sec., averaged
Cold start	45 sec., averaged
- 4) Position accuracy:

A) Non DGPS (Differential GPS)

Position	5-25 meter CEP with SA off
Velocity	0.1 meters/second, with SA off
Time	1 microsecond synchronized GPS time

B) DGPS (Differential GPS)

Position	1 to 5 meter, typical
Velocity	0.05 meters/second, typical

5) Dynamic Conditions:

Altitude	18,000 meters (60,000 feet) max
Velocity	515 meters / second (1000 knots) max
Acceleration	4 G, max
Jerk	20 meters/second, max

1.3.5 Interfaces

- 1) Dual channel RS-232 or TTL compatible level, with user selectable baud rate (4800-Default, 9600, 19200, 38400).
- 2) NMEA 0183 Version 2.2 ASCII output (GPGGA, GPGLL, GPGSA, GPGSV, GPRMC, GPVTG).
- 3) Real-time Differential Correction input (RTCM SC-104 message types 1, 5 and 9).
- 4) SiRF protocol.

2. Operational characteristics

2.1 Initialization

As soon as the initial self-test is complete, the GPS-300 begins the process of satellite acquisition and tracking automatically. Under normal circumstances, it takes approximately 45 seconds to achieve a position fix, 38 seconds if ephemeris data is known. After a position fix has been calculated, information about valid position, velocity and time is transmitted over the output channel.

The GPS-300 utilizes initial data, such as last stored position, date, time and satellite orbital data, to achieve maximum acquisition performance. If significant inaccuracy exists in the initial data, or the orbital data is obsolete, it may take more time to achieve a navigation solution. The GPS-300 Auto-locate feature is capable of automatically determining a navigation solution without intervention from the host system. However, acquisition performance can be improved when the host system initializes the GPS-300 in the following situation:

- 1) Moving further than 1,500 kilometers.
- 2) Failure of data storage due to the inactive internal memory battery.

2.2 Navigation

After the acquisition process is complete, the GPS-300 sends valid navigation information over output channels. These data include:

- 1) Latitude/longitude/altitude
- 2) Velocity
- 3) Date/time
- 4) Error estimates
- 5) Satellite and receiver status

The GPS-300 sets the default of auto-searching for real-time differential corrections in RTCM SC-104 standard format, with the message types 1, 5, or 9. It accomplishes the satellite data to generate a differential (DGPS) solution. The host system, at its option, may also command the GPS-300 to output a position whenever a differential solution is available.

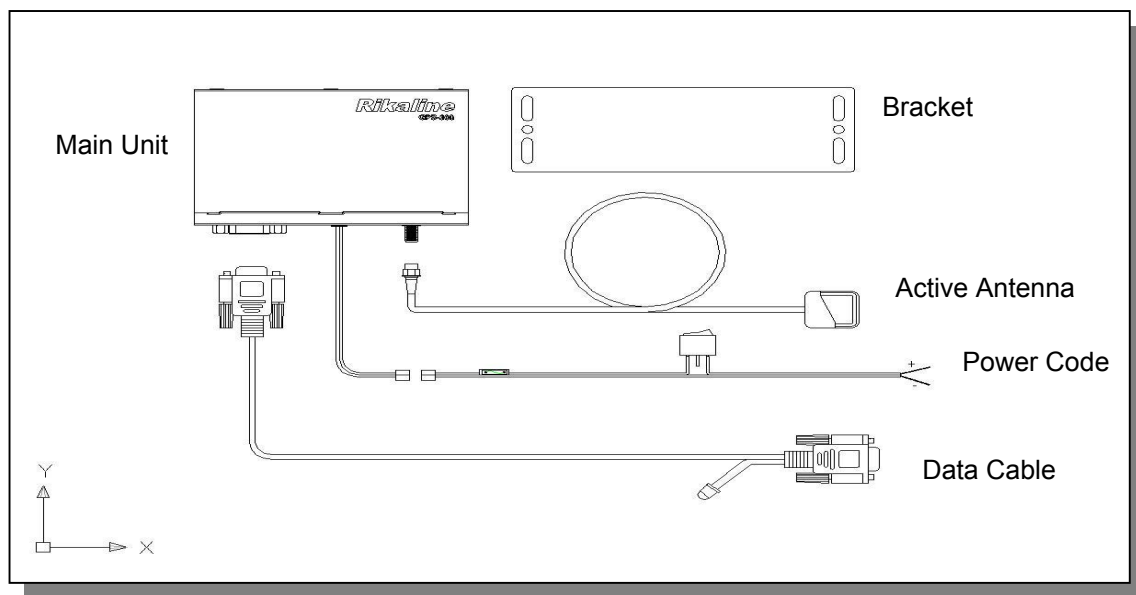
3. Hardware interface

3.1 Dimension

Size: 120.0(W) x 80.0 (D) x 26.0(H) (mm)
4.72"(W) x 3.15" (D) x 1.02"(H).

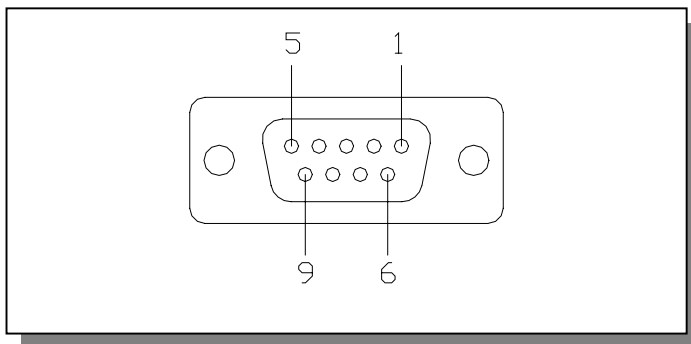
3.2 Hardware Interface

The GPS-300 includes a GPS receiver and constant voltage regulator in a metal box. After installation, connect the power cable, active antenna and data cable, you will have a deluxe great GPS unit in your mobile living facility. Any device you have for navigation, you just need to connect a suitable data cable. Then it starts to work for you. All accessories are listed and described below:



3.3 Connector

3.3.1 DB9 Male Connector Function Definition:



Pin	Signal Name
1	-GND
2	LED-
3	RS-232 RX
4	RS-232 TX
5	N/A
6	VCC +5
7	LED+
8	TTL RX
9	TTL TX

3.3.2 Power Code Specification

Cable: Dual-wire at 16AWG
Length: 300mm with lock type connector

3.3.3 Active Antenna Connector

Type: SMA female
Length: 10mm

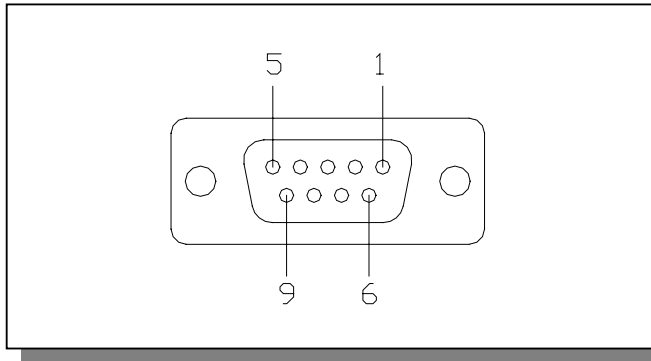
3.3 Standard Accessories

3.3.1 RS-232 Data Cable

1. Cable Length: 1.5 meter
2. Connector: DB9 female at 2 ends
3. Positioning status LED: at device end
4. Part No.: A-6018-C

3.3.1.1 DB9 Female Connector Function Definition:

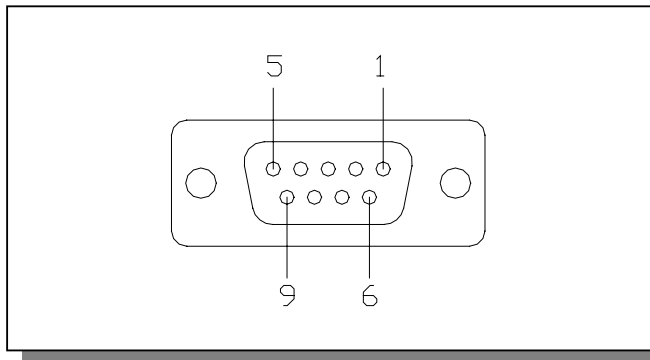
GPS end (close to GPS-300 main unit)



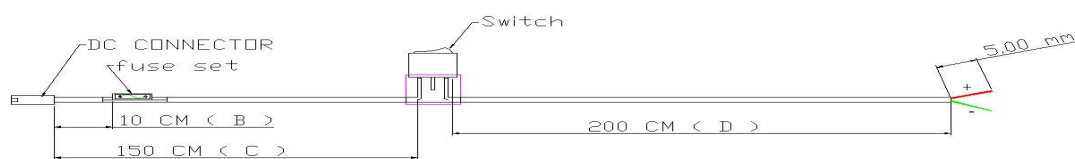
Pin	Signal Name
1	N/A
2	RS-232 TX
3	RS-232 RX
4	LED-
5	-GND
6	N/A
7	N/A
8	LED+
9	N/A

3.3.1.2 DB9 Female Connector Function Definition:

Device end (close to PC)



Pin	Signal Name
1	N/A
2	RS-232 TX
3	RS-232 RX
4	N/A
5	-GND
6	N/A
7	N/A
8	N/A
9	N/A

3.3.2 Power Cable

1. Cable Length: Part B: 0.1 meter
Part C: 1.5 meter
Part D: 2.0 meter
2. Fuse: 2A at 250V
3. Connector (to GPS-300) Lock type
4. Rocker Switch:
Size: 31 x 22 x 18mm
Type: 2 poles (ON-OFF)
Capacitv: 16A at 250V

3.3.3 Active Antenna

1. Connector: SMA female
2. Cable length: 5 meters RG-174
3. Antenna Gain: 26-28dB

3.3.4 Close-end Connector

1. Size: CE-1: 20mm (22-16AWG), CE-2: 20mm(16-14AWG), CE-5: 25.3mm(12-10AWG)
2. 3 pieces each, total 9 pieces

3.3.5 Velcro

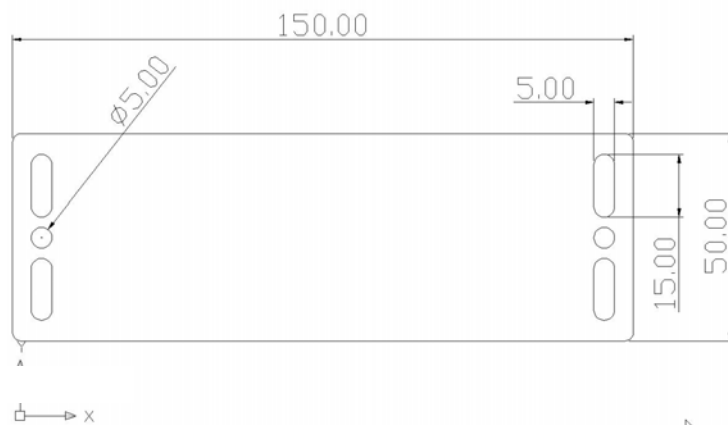
Size: 100 x 60mm

3.3.6 Cable Ties

Size: 170(L) x 5(W) x 1(T) mm

3.3.7 Bracket w/ 2 screws

The GPS-300 is equipped with a standard bracket for installing in the car. Part No. 80014 you may fix it by using enclosed screws or cable ties.

**3.4 Optional Accessories****3.4.1 A-6019 Series PDA Date Cable**

Cable Length: 1.5 meter w/ PDA connector and Positioning Status LED.

3.4.1.1 Available List

Part No.	Application	Part No.	Application
A-6019-A	ASUS A-600	A-6019-P	Palm/IBM Vx
A-6019-A1	ASUS A-620	A-6019-P1	Palm/IBM 500/505/515
A-6019-AR	ACER S-60	A-6019-P2	Palm Zire 71
A-6019-B	Besta	A-6019-P3	Palm Tungstem T/T2/T3
A-6019-C	Casio E-115	A-6019-Q	I-Paq 36xx/37xx
A-6019-C1	Casio E-125/EM-500	A-6019-Q1	I-Paq 38xx/39xx/54xx
A-6019-C2	Casio E-200	A-6019-S	Sony N-7xx/S-xx
A-6019-D	Dell Axim X5	A-6019-S1	Sony T/NR/SL/SJ
A-6019-D1	Dell Axim X3	A-6019-SM	Simens
A-6019-H	HP	A-6019-T1	Toshiba E-570
A-6019-HS	HandSpring Treo	A-6019-T2	Toshiba E-740/E-330
A-6019-HS1	HandSpring Visor/Prism	A-6019-T3	Toshiba E-400
A-6019-HS2	HandSpring Edge	A-6019-T4	Toshiba E-800
A-6019-L	Siemens Loox	A-6019-X	O2 XDA/T-Mobile MDA
A-6019-M	Mio 528/338, ViewSonic	A-6019-X1	T-Mobile MDA-2
A-6019-N	NEC 300E		
A-6020	USB CABLE TYPE A		

4. USB Driver

4.1 System Requirements

IBM, Pentium or above and other compatible PC; 16 MB and above memory; Windows 98/Me/2000; VGA Graphic Adapter.

4.2 Installation

1. Copy entire <GPS-300 USB> folder from CD to hard disk.
2. Connect GPS-300 USB connector to computer. While the computer automatically starts the installation program, please direct the driver to the <GPS-300 USB> folder.
3. After the installation is complete, go to <Device Manager> and select <Ports (COM & LPT)> to verify if a virtual COM port <USB to Serial Port> was created.

4.3 Important

Verify the COM port # to start using your own navigating software.

1. Click **<Start>** menu, select **<Settings>**, then enter **<Control Panel>**.
2. After entering **<Control Panel>**, select **<System>**.
3. Select **<Device Manager>**.
4. Find the **<Connect Port>** and check the Virtual COM Port, which was created by the USB driver. Please note that the Virtual COM Port number might be different from every computer. Before using navigating software, please confirm the COM Port numbers created by your computer and provided by your navigation software. They must be the same Com Port numbers. Otherwise, the navigating software won't receive the satellite signal for the un-match COM Port setting.

5. Warranty

The GPS-300 is warranted to be free from defects in material and functions for one year from the date of purchase. Any failure of this product within this period under normal conditions will be replaced at no charge to the customers.

Appendix A Software Interface

The GPS-300 interface protocol is based on the National Marine Electronics Association's NMEA 0183 ASCII interface specification, which is defined in NMEA 0183, Version 2.2 and the Radio Technical Commission for Maritime Services (RTCM Recommended Standards For Differential Navstar GPS Service, Version 2.1, RTCM Special Committee No.104).

A.1 NMEA Transmitted Messages

The GPS-300 supported by SiRF Technology Inc. also outputs data in NMEA-0183 format as defined by the National Marine Electronics Association (NMEA), Standard.

The default communication parameters for NMEA output are 4800 baud, 8 data bits, stop bit, and no parity.

Table A-1 NMEA-0183 Output Messages

NMEA Sentence	Description
GPGGA	Global positioning system fixed data
GPGLL	Geographic position latitude \ longitude
GPGSA	GNSS DOP and active satellites
GPGSV	GNSS satellites in view.
GPRMC	Recommended minimum specific GNSS data
GPVTG	Course over ground and ground speed

A.1.1 Global Positioning System Fix Data (GGA)

Table A-2 contains the values for the following example:

\$GPGGA,161229.487,3723.2475,N,12158.3416,W,1,07,1.0,9.0,M,, , ,0000*18

Table A-2 GGA Data Format

Name	Example	Units	Description
Message ID	\$GPGGA		GGA protocol header
UTC Time	161229.487		Hhmmss.sss
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
Position Fix Indicator	1		See Table 5-3
Satellites Used	07		Range 0 to 12
HDOP	1.0		Horizontal Dilution of Precision
MSL Altitude	9.0	Meters	
Units	M	Meters	
Geoid Separation		Meters	
Units	M	Meters	
Age of Diff. Corr.		second	Null fields when DGPS is not used
Diff. Ref. Station ID	0000		
Checksum	*18		
<CR> <LF>			End of message termination

Table A-3 Position Fix Indicator

Value	Description
0	0 Fix not available or invalid
1	GPS SPS Mode, fix valid
2	Differential GPS, SPS Mode, fix valid
3	GPS PPS Mode, fix valid

A.1.2 Geographic Position with Latitude/Longitude (GLL)

Table A-4 contains the values for the following example:

\$GPGLL,3723.2475,N,12158.3416,W,161229.487,A*2C

Table A-4 GLL Data Format

Name	Example	Units	Description
Message ID	\$GPGLL		GLL protocol header
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
UTC Position	161229.487		hhmmss.sss
Status	A		A=data valid or V=data not valid
Checksum	*2C		
<CR> <LF>			End of message termination

A.1.3 GNSS DOP and Active Satellites (GSA)

Table A-5 contains the values for the following example:

\$GPGSA,A,3,07,02,26,27,09,04,15, , , , ,1.8,1.0,1.5*33

Table A-5 GSA Data Format

Name	Example	Units	Description
Message ID	\$GPGSA		GSA protocol header
Mode 1	A		See Table 5-6
Mode 2	3		See Table 5-7
Satellite Used (1)	07		Sv on Channel 1
Satellite Used (1)	02		Sv on Channel 2
.....		
Satellite Used			Sv on Channel 12
PDOP	1.8		Position Dilution of Precision
HDOP	1.0		Horizontal Dilution of Precision
VDOP	1.5		Vertical Dilution of Precision
Checksum	*33		
<CR> <LF>			End of message termination

(1) Satellite used in solution.

Table A-6 Mode 1

Value	Description
M	Manual—forced to operate in 2D or 3D mode
A	2D Automatic—allowed to automatically switch 2D/3D

Table A-7 Mode 2

Value	Description
1	Fix Not Available
2	2D
3	3D

A.1.4 GNSS Satellites in View (GSV)

Table A-8 contains the values for the following example:

\$GPGSV,2,1,07,07,79,048,42,02,51,062,43,26,36,256,42,27,27,138,42*71
\$GPGSV,2,2,07,09,23,313,42,04,19,159,41,15,12,041,42*41

Table A-8 GSV Data Format

Name	Example	Units	Description
Message ID	\$GPGSV		GSV protocol header
Number of Messages	2		Range 1 to 3
Message Number	1		Range 1 to 3
Satellites in View	07		Range 1 to 12
Satellite ID	07		Channel 1 (Range 1 to 32)
Elevation	79	degrees	Channel 1 (Maximum 90)
Azimuth	048	degrees	Channel 1 (True, Range 0 to 359)
SNR (C/No)	42	dBHz	Range 0 to 99, null when not tracking
....		
Satellite ID	27		Channel 4 (Range 1 to 32)
Elevation	27	degrees	Channel 4 (Maximum 90)
Azimuth	138	degrees	Channel 4 (True, Range 0 to 359)
SNR (C/No)	42	dBHz	Range 0 to 99, null when not tracking
Checksum	*71		
<CR> <LF>			End of message termination

NOTE: Items <4>,<5>,<6> and <7> repeat for each satellite in view to a maximum of four (4) satellites per sentence. Additional satellites in view information must be sent in subsequent sentences. These fields will be null if unused.

A.1.5 Recommended Minimum Specific GNSS Data (RMC)

Table A-9 contains the values for the following example:

\$GPRMC,161229.487,A,3723.2475,N,12158.3416,W,0.13,309.62,120598, ,*10

Table A-9 RMC Data Format

Name	Example	Units	Description
Message ID	\$GPRMC		RMC protocol header
UTC Time	161229.487		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	3723.2475		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	12158.3416		dddmm.mmmm
E/W Indicator	W		E=east or W=west
Speed Over Ground	0.13	Knots	
Course Over Ground	309.62	Degrees	True
Date	120598		ddmmyy
Magnetic Variation (1)		Degrees	E=east or W=west
Checksum	*10		
<CR> <LF>			End of message termination

(1) SiRF Technology Inc. does not support magnetic declination. All “course over ground” data are geodetic WGS84 directions.

A.1.6 Course Over Ground and Ground Speed

Table A-10 contains the values for the following example:

\$GPVTG,309.62,T, ,M,0.13,N,0.2,K*6E

Table A-10 VTG Data Format

Name	Example	Units	Description
Message ID	\$GPVTG		VTG protocol header
Course	309.62	Degrees	Measured heading
Reference	T		True
Course		Degrees	Measured heading

Reference	M		Magnetic (1)
Speed	0.13	Knots	Measured horizontal speed
Units	N		Knots
Speed	0.2	Km/hr	Measured horizontal speed
Units	K		Kilometers per hour
Checksum	*6E		
<CR> <LF>			End of message termination

(1) SiRF Technology Inc. does not support magnetic declination. All “course over ground” data are geodetic WGS84 directions.

A.2 RTCM Received Data

The default communication parameters for DGPS Input are 9600 baud, 8 data bits, stop bit, and no parity. Position accuracy of less than 5 meters can be achieved with the GPS-300 by using Differential GPS (DGPS) real-time pseudo-range correction data in RTCM SC-104 format, with message types 1, 5, or 9. As using DGPS receiver with different communication parameters, GPS-300 may decode the data correctly to generate accurate messages and save them in battery-back SRAM for later computing.

Appendix B Earth Datums & Output Setting

B.1 Earth Datums

The GPS-300 is built in earth datum with WGS84.

B.2 Setting

B.2.1 Manufacturing Default

Datum: WGS84.

Baud Rate: 4800.

Output: GGA, GSA, GSV, RMC, VTG.

B.2.2 Baud Rate and Output Sentences Setting

B.2.2.1 By SiRFDemo Program

- 1// Connect your GPS-300 to PC (either COM or USB)
- 2// Execute SiRFDemo.exe (Program is in the CD)
- 3// When "Data Source Setup" shows, select the port (COM 1, 2 or 3....) you used, click "OK".
- 4// Click "Action", select "Open Data Source", Then you will see lots of sentences shows. All the sentences start with \$GPxxxx. This is NMEA protocol. If you do not see these sentences, please click "View", "Select Message", then click "Development". The message will appear. If it still shows nothing, then continue below steps.
- 5// There is a screen "Selection of Target Receiver Software" might appear, please select "SiRFstar II".
- 6// Click "Action", Select "Switch to SiRF Protocol". Then you will see SiRF binary and the sentences start with #Time, shows every 4 lines and you can not see the sentences start with \$GP. These sentences are for setting or viewing the GPS receiver's performance. If your software is using standard NMEA protocol, please do the following:
- 7// Click "Action", Select "Switch to NMEA Protocol". You will see GGA, GSV, GSA and RMC in black and the Baud Rate is 4800. These are the default we put inside the receiver. Please click "OK". Then you can use it as a standard GPS receiver. If your software uses different sentence, please choose the sentences you need.

After above actions, the new setting will be kept in SRAM. If no power supplied to GPS-300 for more than 30 days, user must re-set again when power on.

B.2.2.2 By other SiRF based demo program

There are a few companies or private website providing some very good demo software.

Appendix C Ordering Information

C.1 Standard Package

Main Unit: GPS Receiver and Power Converter built in the housing.

Mounting Accessories: Metal Bracket + 2 Screws (for plastic) Comes Fixed with Glue

Cable Ties x 4 pieces

Velcro x 1 Set

Power Cable: 1.5m with connector & Fuse + Rocker Switch +2m Baring End + 2 Close-end Wire

Connector x 3 Sets in Different Diameter.

External Active Antenna (A-10305-SA): SMA connector, 5m Cable, 26dB Gain

Data Cable (A-6018-C): 1.5m RS-232 with Positioning Status LED.

Miscellaneous: CD + Warranty Card + Quick installation reference.

C.2 Optional Accessories

C.2.1 PDA Data Cable

Seq.	Part No.	Appl. Model
1	A-6019-A	ASUS A-600
2	A-6019-A1	ASUS A-620
3	A-6019-AR	ACER S-60
4	A-6019-B	Besta
5	A-6019-C	Casio E-115
6	A-6019-C1	Casio E-125/EM-500
7	A-6019-C2	Casio E-200
8	A-6019-D	Dell Axim X5
9	A-6019-D1	Dell Axim X3
10	A-6019-H	HP
11	A-6019-HS	HandSpring Treo
12	A-6019-HS1	HandSpring Visor/Prism
13	A-6019-HS2	HandSpring Edge
14	A-6019-L	Siemens Loox
15	A-6019-M	Mio 528/338, ViewSonic
16	A-6019-N	NEC 300E
17	A-6019-P	Palm/IBM Vx
18	A-6019-P1	Palm/IBM 500/505/515
19	A-6019-P2	Palm Zire 71
20	A-6019-P3	Palm Tungstem T/T2/T3
21	A-6019-Q	I-Paq 36xx/37xx
22	A-6019-Q1	I-Paq 38xx/39xx/54xx
23	A-6019-S	Sony N-7xx/S-xx
24	A-6019-S1	Sony T/NR/SL/SJ
25	A-6019-SM	Simens
26	A-6019-T1	Toshiba E-570
27	A-6019-T2	Toshiba E-740/E-330
28	A-6019-T3	Toshiba E-400
29	A-6019-T4	Toshiba E-800
30	A-6019-X	O2 XDA/T-Mobile MDA
31	A-6019-X1	T-Mobile MDA-2

C.2.2 PC Data Cable

1. A-6018-C: 1.5m RS-232 with Positioning Status LED.

2. A-6020: USB Cable Type A

C.2.3 PC Holder

1	A-2001	PDA Holder, Suction Cup, 150mm, Short Arm
2	A-2001-L	PDA Holder, Suction Cup, 150-320mm Adjustable
3	A-2002-A	PDA Holder, Suction Cup, 150mm, Short Arm, Magnetic Pad
4	A-2002-AL	PDA Holder, Suction Cup, 320mm, Long Arm, Magnetic Pad
5	A-2005-A	PDA Holder, Suction Cup, 150mm, Short Arm, 4-Claw
6	A-2005-AL	PDA Holder, Suction Cup, 320mm Long Arm, 4-Claw
7	A-2006-A	PDA Holder, Suction Cup, 150mm Short Arm, 3-Claw
8	A-2006-AL	PDA Holder, Suction Cup, 150mm Long Arm, 3-Claw
9	A-2007	PDA Holder, Suction Cup, 150mm Straight Short Arm, 4-Claw
10	A-2008	PDA Holder, Suction Cup, 150mm Straight Short Arm, 3-Claw

C.3 Application Combination**C.3.1 For Car Navigation****C.3.1.1 For PC w/RS-232 Interface**

1. GPS-300 with standard accessories.

C.3.1.2 For PC w/USB Interface

1. GPS-300 with standard accessories.
2. A-6020

C.3.1.3 For PDA Application

1. GPS-300 with standard accessories
2. A-6019 Series

C.3.1.4 For Other Land Application

1. GPS-300 with standard accessories
2. A-6018-C / A-6020 or Special Cable

C.3.1.5 For Marine Application

1. GPS-300 with standard accessories
2. A-6018-C / A-6020 or Special Cable